THE EFFECTIVENESS OF TACTUS THERAPY FOR INDIVIDUALS WITH APRAXIA OF SPEECH

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To my family, especially to mom, aunt Juliette, and uncle James

This research would not be complete without the help and patience of Dr. Forrest, Dr. Stark, and Dr. Anderson. Thank you for all you have taught me and continue to teach me. Furthermore, thank you to the participant and his wife, who were a joy to work with!

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Acquired Apraxia of Speech (AOS) is characterized as a neurogenic impairment of motor planning for speech such that an individual with this disorder may know what they want to say, but their brain has a difficult time forming the words as they speak (Duffy, 2003). There are a variety of therapy approaches to treat such as those that focus on articulatory-kinematic training or cueing procedures such as integral stimulation (American Speech-Language-Hearing Association, n.d.) and with constant innovation, technology is becoming a common tool for individuals in therapy for AOS. This study aims to determine how effective technology-based speech therapy, specifically one by Tactus Therapy Solutions© is for an individual with AOS. Tactus Therapy Solutions© has created many applications (apps) for speech pathologist and clients alike to use in therapy, and in the comfort of their homes. One app in particular, Apraxia Therapy, was chosen for this study to investigate the application's ability to improve production of longer phrases and longer words by an individual with AOS; the app's ability to promote generalization to words and phrases outside of those used in treatment; and finally this individual's ability to accurately self-judge his speech production when working alone with the application.

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Chapter 1

Introduction

1.1 Apraxia of Speech

Acquired Apraxia of Speech is characterized as a neurogenic impairment of motor planning for speech such that individuals with this disorder may know what they want to say, but their brain has a difficult time forming the words as they speak (Duffy, 2013). Apraxia of Speech is not caused by weakness of articulator muscles, which is what makes it different from Dysarthria. Apraxia of Speech often occurs with Aphasia, a neurogenic disorder that can cause difficulty expressing and understanding language; For the duration of the paper, AOS will be used to refer to the co-morbidity of Apraxia of Speech and Aphasia because it is rare that apraxia of speech presents itself in stroke patients without Aphasia (Weiss, P. H., Ubben, S. D., Kaesberg, S., Kalbe, E., Kessler, J., Liebig, T., & Fink, G. R., 2016). Because Apraxia of Speech can be present in conjunction with Aphasia (Patidar et al., 2013), it can be challenging to assess and to find a treatment that alleviates the symptoms of Apraxia of Speech alone.

1.2 Awareness of Error

Awareness of error is a key component to consider in AOS therapy as it describes an individual's ability to accurately identify and judge their speech production errors (Mauszycki, S. C., Bailey, D. J., & Wambaugh, J. L. (2017). According to Mauszycki et al. (2017), people with AOS vary in their awareness of error; this is to say that some individuals may be better at identifying their own errors than others. A study completed by Wambaugh et al. in 2016 revealed that the participants were able to identify their productions of multi-syllabic words as correct or incorrect accurately in 82.3% of opportunities; the participants in this study had chronic AOS and aphasia following a single left-hemisphere stroke. As new interventions for individuals with

AOS are explored, awareness of error will be significant to consider if a patient completes therapy activities at home without the aid of a speech-language pathologist.

1.3 Main therapy types for AOS

Symptoms such as groping, inconsistent errors, and distorted sounds are the main markers for AOS (Croot, 2002). According to ASHA, there are four main therapy types for individuals with AOS (American Speech-Language-Hearing Association. (n.d.)). The four types include Articulatory-kinematic approaches, Rate and Rhythm Control approaches, Augmentative and Alternative Communication (AAC), and Sensory Cueing approaches. Each approach aims to tackle a different aspect of apraxia of speech and should be used only after considering the individual needs of each client.

1.3.1 Articulatory-kinematic approaches

Articulatory-kinematic approaches include the Multiple Input Phoneme Therapy (MIPT), script training, Sound Production Treatment (SPT), and Speech Motor Learning (SML). This group of therapy approaches focuses on motor planning by using intense repetition and articulatory cues (American Speech-Language-Hearing Association. (n.d.)). Repetition practice has been demonstrated as essential for an individual recovering from a stroke or brain injury because it can promote long-lasting neurological change (Kleim & Jones, 2008). Articulatory cues provide an increased awareness of the correct production of sounds and provide an individual with consistent correction of place, manner, and voicing of sounds (Mauszycki, & Wambaugh, 2011). Like repetition and articulatory cues, the use of different sensory cueing approaches, such as integral stimulation (Rosenbek, Lemme, Ahern, Harris & Wertz, 1973) can give individuals increased opportunity to develop proper productions of phrases and words.

1.3.2 Sensory Cueing Approaches

Integral Stimulation, tactile cueing, and visual cueing are three of the sensory cueing approaches used in the treatment of AOS. This group of therapy approaches focuses on providing cues for the movement sequences needed to create connected speech (American Speech-Language-Hearing Association (n.d.)). Individually, these approaches are used to provide sensory input that helps an individual form their articulatory configurations accurately for speech output (Bose, Square, Schlosser & van Lieshout, 2001). According to Bose et al. (2001), sensory input can include cues on voicing, timing, labial rounding, mandibular opening and more. The sensory approaches utilize external cues to help an individual re-learn speech movements.

1.3.2.1 Integral stimulation

Although Integral Stimulation (IS) fits well within the sensory cueing approaches, it has also been considered a part of different treatment approaches. IS uses multiple types of sensory cues (e.g. tactile, auditory, visual) to assist an individual with AOS in imitation (American Speech-Language-Hearing Association. (n.d.)). This approach includes steps that at first include the clinician and the client speaking together, and eventually the client speaking alone. The nine steps included in IS are included below (Rosenbek et al., 1973)

Step I. Integral Stimulation (look at me, watch me) and simultaneous production (client-clinician saying it together).

Step II. Integral Stimulation and delayed production (client saying it after the clinician) with visual cue

Step III. Integral Stimulation and delayed production with no visual cue

Step IV. Integral Stimulation and successive productions without intervening stimulation of auditory or visual.

Step V. Simultaneous production with written stimuli only. Client reads the responds form board or cards.

Step VI. Delayed production with visual cue only. In this condition, the stimulus is written and then erased or concealed before client attempts it.

Step VII. Appropriate response prompted by a question.

Step VIII. Appropriate response in role playing situation when clinician, appearing as a nurse, walks into the therapy room.

Step IX. Appropriate response in a true-life situation.

The nine steps gradually bring a client from reciting the target with the clinician to a real-life situation in which they can produce the target independently. A clinician first follows a "Look at me, watch me" (Rosenbek, et al., 1973) model to show the client a correct production; this first step includes auditory and visual cues. The steps to follow include the clinician and the client saying the target together, and eventually the client will say the target individually. Although research includes nine steps in IS, these steps can and should be tailored to each individual and their particular needs (Rosenbek et al., 1973).

1.3.3 Rate and Rhythm Control Approaches

Rate and Rhythm Control approaches utilize melody, rhythm, and stress to increase speech production (American Speech-Language-Hearing Association, n.d.). These approaches, also known as prosodic facilitation approaches, include contrastive stress, Melodic Intonation Therapy (MIT), Metrical Pacing Treatment (MPT), and rhythmic pacing. Improved speech production is achieved by using a hierarchal approach that teaches an individual to rely on

intonation while producing phrases and sentences (Sparks & Holland, 1976). As individuals increase the length of phrases and sentences, they eventually decrease their reliance on the feedback of the clinician and the need for intonation reliance. Although rate and rhythm control has shown improvements in speech production in individuals with left hemisphere damage (Martin, Kubitz & Maher, 2001), the effect it has on individuals with AOS remains unclear. Because AOS causes a disturbance in typical speech rate and one's ability to repeat that are difficult to alter in treatment (Wambaugh & Mauszycki, 2010), rate and rhythm control therapy approaches are difficult to use and have a varying success rate among these individuals.

1.3.4 Augmentative and Alternative Communication (AAC)

Augmentative and Alternative Communication (AAC) can be used as an alternative or supplemental form of communication for individuals with AOS, particularly those with severe AOS. Many studies have shared the benefits of an AAC device for adults with acquired speech and language disorders (Beukelman, Fager, Ball & Dietz, 2007). Among these benefits, AAC includes a number of communication platforms such as books, drawing, and writing (Beukelman, Fager, Ball & Dietz, 2007). Providing a variety of platforms can make AAC accessible to multiple individuals with different needs and strengths. Unfortunately, many patients with acquired AOS are uncomfortable with using AAC, in part because of fears that AAC use will inhibit the recovery of speech abilities (Beukelman and Ball, 2002).

1.4 Advantages and Disadvantages of Technology-Based Therapy

Figure 1 presents a summary of the advantages and disadvantages of technology-based treatment for acquired neurogenic communication disorders. The following sections elaborate on these points.

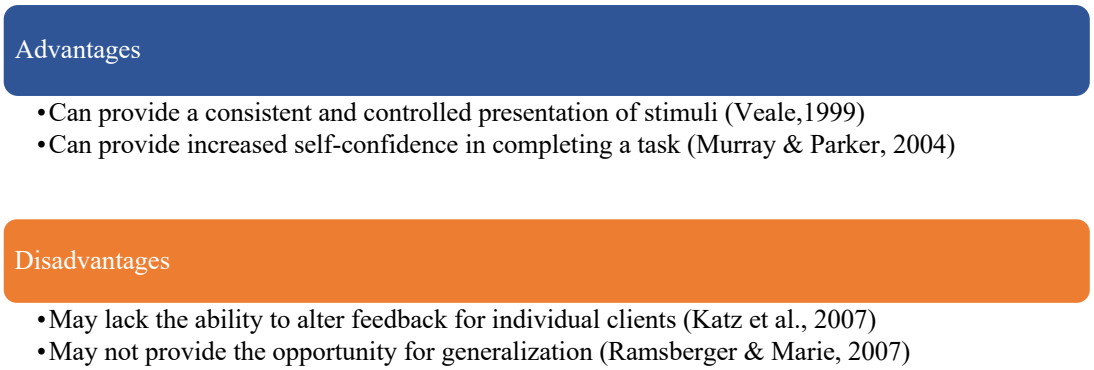

Figure 1. Summary of Advantages and Disadvantages of Technology-Based Therapy

1.4.1 Advantages

The continued use of technology in therapy is foreseeable as innovation continues in society; previous research has shown many benefits of using technology as a therapy tool, specifically for individuals with AOS and/or Aphasia secondary to stroke (Ballard, Etter, Shen, Monroe & Tan, 2019; Stark & Warburton, 2018). Two benefits that are particularly useful for improvement in speech therapy are the accuracy in auditory input or stimulation, and the potential for increased self-confidence in completing therapy task.

The use of technology can provide a consistent and controlled presentation of stimuli (Veale,1999), which is useful for an individual with AOS, who benefits from a consistent model. Regardless of the number of times an individual interacts with the stimuli on a computer-based activity, they will receive the same example of the target word, whereas a clinician's repeated models of the target are likely to vary in unpredictable ways from token to token.

A computer-based tool can provide increased self-confidence in completing a task, which can, in turn, improve the individual's interaction with the stimuli and use of their strategies outside of therapy. This effect was shown in a study with the Sound Therapy Lite application completed by Murray and Parker in 2004. Students between the ages of 6-7 years old with articulation disorders were asked to use the articulation therapy-based application and

participants reported an enjoyment in "the ability to hear themselves produce a sound and compare it to a computer-generated model" (Murray & Parker, p. 6). Because they could hear themselves while using the application, this also made participants more aware when speaking to their peers and parents. The results of this study demonstrate a computer-based intervention's ability to increase self-awareness outside of therapy.

1.4.2. Disadvantages

While the use of technology in rehabilitation can provide a valuable tool in recovery and compensation development, it can lack the ability to alter feedback for the particular needs of an individual client. Furthermore, technology may not provide the opportunity for generalization in each client because it doesn't consider individual strengths prior to therapy.

Research has shown that individuals with comorbid AOS and aphasia vary in their treatment outcomes based on the frequency of augmented feedback (Hula, Robin, Maas, Ballard & Schmidt, 2008). Hula et al. considered how feedback frequency influences retention and transfer of speech skills for individuals with AOS. Study participants were between 6 and 20 months (M = 13.3 months) post AOS onset following a left-hemisphere middle cerebral artery stroke. The six subjects included in the single-subject studies received varied frequency (high versus low) and feedback timing (immediate or delayed). The results varied across the six participants in that one participant improved with decreased frequency of feedback given directly following a task, another benefited more from delayed feedback after a task that was provided 100% of the time. It is likely that individuals responded differently based on their own AOS profiles and individual needs. This suggestion is supported by another study in which participants with AOS and aphasia also responded differently to the feedback schedules presented; augmented visual feedback improved the speech output of some participants, but not

all participants (Katz, Garst, Carter, McNeil, Fossett, Doyle & Szuminsky, 2007). As in the Hula et al. study, the individuals included in the Katz et al experiment were past the acute stage of impairment. The subjects were 1 to 2 years post left hemisphere stroke and presented with mild-severe AOS and aphasia. In this study, when feedback was provided 50% of the time it was associated with improved acquisition and maintenance of a stimulus, whereas when feedback was provided 100% of the time, it was associated with faster learning but poor generalization and long-term maintenance. While this was the general result for different amounts of feedback, a portion of the participants responded differently as they had different needs and abilities coming into the study.

In an effort to increase the amount of treatment available to people with AOS, computerized therapy tools have been developed to work with a variety of clients on the basis of general characteristics associated with a particular disorder. While the content included in a therapy app may be useful to the clients, it may not always provide generalization of learning of similar stimuli outside of the tool. Current research shows a mixed outcome when considering the opportunity for generalization while using therapy-based applications. Some studies have shown that while some participants with aphasia (i.e., no indication of comorbid AOS) who used computer-based treatments show generalization, the generalization is often weak, and many of the participants show no generalization at all (Ramsberger & Marie, 2007). Ramsberger and Marie included participants who were at least 6 months post unilateral left hemisphere stroke with no coexisting neurological conditions. They included a computer-based therapy program used to increase naming in individuals with aphasia in their study. The use of the program resulted in significant gains in the participants' ability to name objects, however, when tested for

generalization outside of the program, half of the participants showed weak evidence of generalization to untrained stimuli.

Contrary to the findings in Ramsberger and Marie's study (2007), Stark and Warburton (2018) found generalization while using computer-based applications for individuals with aphasia without any comorbid communication disorders. Their study included the use of Language Therapy, another Tactus Therapy Solutions© application, in individuals with chronic expressive aphasia. The Language Therapy application focuses on writing, naming, reading, and comprehension. Following four weeks of daily application use, the majority of participants improved their Comprehensive aphasia Tests (CAT; Swinburn, Porter & Al, 2004) scores, and their spontaneous speech improved (Stark & Warburton). It should be noted that the stimuli from the CAT and spontaneous speech samples were not included within the application. This shows that the individuals with aphasia improved on stimuli presented outside of the application following their 4-week use.

1.5 Apraxia Therapy from Tactus Therapy

Tactus Therapy Solutions© created a multitude of apps designed to provide additional therapy tools for professional speech pathologists to use with clients, and for clients to use at home on their own. The app used in this case study, Apraxia Therapy, provides three main areas of focus: sequencing (e.g. ABCs, counting, days of the week), phrases, and long words. Phrases and long words were used for this study. The phrases span from level 1 (e.g. 2-word phrases) to level 7 (e.g. 4 and 5-word phrases) and the long words span from 2 syllable to 5 syllable words, with each level increase associated with increased motor complexity. Each increase in level includes more complex sound sequences (e.g., clusters; variations in place and manner of articulation) and longer phrases.

This application uses the Integral Simulation Approach to AOS treatment (Rosenbek et al., 1973). The participant in this study was asked to use the phrases and long words sections within the application. Because at the start of the study the participant had limited speech, including only two to three-word utterances and three syllable words, the goal for this study was to expand the utterances and length of words of the participant.

1.6 Study Focus

While the Apraxia Therapy application provides a variety of content and difficulty levels (i.e., with phrases and long words), the current study investigated whether the participant was able to generalize the learning of more complex phrases and words from the app to untrained stimuli (i.e., words and phrases that were not part of the application training). This information is important for speech pathologists and clients alike because without the ability to generalize learning outside of the therapy, therapy benefit is limited. The current study also investigated the participant's ability to accurately judge his own productions without the guidance of a speech pathologist.

As noted earlier, recommended treatment for AOS includes multiple repetitions of utterances and a gradual building on previous skills. This type of regimen can be very time-intensive and, therefore, may not be practical for many clients. For example, an individual who cannot afford a health care plan that includes coverage for the amount of appointments needed for AOS treatment would have limited access; many adults in the U.S. have reported low access in care due to the health insurance cost (Schoen, Osborn, Squires & Doty, 2013). For these reasons, more independent therapy modes that are based on common technology may be preferable for some clients with AOS.

Prior evidence has shown a mixed outcome of improvement for individuals with aphasia without Apraxia of Speech (Ramsberger and Marie's study (2007); Stark and Warburton (2018)) after the use of a technologically based therapy. This study hoped to find out if technologically based therapy could yield promising results for individuals with AOS, which commonly co-occurs with aphasia. It was hypothesized that the participant would increase production of utterance complexity with the stimuli included in the Apraxia Therapy application, but that the participant would have a difficult time generalizing his ability to use complex utterances with phrases and words not included in the application. This is hypothesized due to previous research that reports improvement in functional communication outcomes for individuals with aphasia and mixed outcomes for generalization following the use of applications for therapy. Complex utterances can be defined as including multiple dependent clauses (Arndt & Schuele, 2013), while complex words can be defined by their syllables, length, and multiple meanings (Paetzold & Specia, 2016). Furthermore, because awareness of error varies in individuals with AOS, it was predicted that the participant's perception regarding the accuracy of his own productions would not always match that of the investigator, a final semester, speech pathology graduate student.

Chapter 2

Methodology

2.1 Participant

The participant was a 67-year old male who experienced a left cerebral hemisphere ischemic stroke in 2017, about 3 years prior to the start of this study. The results of the stroke were characterized by a profound expressive language impairment including the inability to name objects; utterance length that was limited to 3-4 words; inability to repeat utterances and difficulty reading; among other speech-language difficulties. He also had a pre-existing essential tremor in his hands causing writing impairment, and this condition was exacerbated by the stroke. An initial diagnosis of severe Broca's aphasia was supported by the completion and interpretation of Part one and subtests of Part two of the Western Aphasia Battery- revised (WAB-R; Kertesz, 2006) in 2017. The results of the WAB-R are displayed in Table 1; scores presented in table 1 are limited because the results in his file within the IU Speech-Language Clinic are mostly qualitative. Clinical testing for aphasia was also completed by a speech-language pathology graduate student during an evaluation of the participant for individual services in the IU Speech-Language Clinic in 2017. The participant was also diagnosed with mild Apraxia of Speech and mild Buccofacial Apraxia at the time of initial evaluation; this diagnosis was based on his display of speech production characteristics that are consistent with AOS as visual evidence of groping and oral nonvolitional movements of the oral mechanism.

In 2019, at approximately two years post-stroke, the participant was enrolled in another research study in the NEURAL Research Lab (PI Stark) and was retested using the Part I of the WAB-R by a Ph.D. student conducting that study. The 2019 assessment revealed moderate Broca's aphasia, these results can be found in Table 2.

Table 1. WAB-R Results of the Participant completed at the IU Speech and Hearing Clinic for individual therapy on April 7, 2017.

Confrontation Naming	**1/60**
Fluency	Longest utterance: 3-4 words
Auditory Comprehension	6.3/10
Reading Comprehension	36/100

Table 2. WAB-R Results of the Participant completed at the Neural Research Lab within the IU Speech and Hearing program for individual therapy on June 12, 2019.

	Max	Client's Score
SPONTANEOUS SPEECH		
Information Content	10	8
Fluency	10	4
Spontaneous Speech Composite	20	13
COMPREHENSION		
Yes/No Questions	60	60
Auditory Word Recognition	60	39
Sequential Commands	80	61
Comprehension Total	200	160
Comprehension Composite	10	8
REPETITION		
Repetition Total	100	32
Repetition Composite	10	3.2
NAMING		
Object Naming	60	51
Word Fluency	20	6
Sentence Completion	10	8
Responsive Speech	10	6
Naming Total	100	71
Naming Composite	10	7.1
Aphasia Quotient	62.6	
Aphasia Type and Severity	Moderate Broca's Aphasia	

The participant had been receiving weekly individual speech therapy at the IU Speech and Hearing Clinic for about 3 years and was a frequent participant of the IU Aphasia Support Group that met once a week. In Aphasia Support Group, the participant engaged in a variety of activities that included the use of multiple modalities of communication (i.e. speaking, writing, drawing). Table 3 presents the goals for this participant, including those in individual therapy in the IU Speech-Language Clinic and in Aphasia Support Group, but not including the goals of the current study. For this case study, the participant worked with goals that targeted different communication objectives than those directly targeted in individual therapy and Aphasia Support Group.

Table 3. The individual goals of the participant have been reworded to maintain confidentiality.

Long Term Goal 1:	**The participant will increase the efficiency and informativeness of communication in a social communication context.**
Short Term Goal 1:	The participant will respond to a question by using 3 pieces of information.
Short Term Goal 2:	The participant will provide a sequence of 3 or more steps in response to a request for procedural information.

At the start of the study, the participant could say three-syllable words and some three-word phrases, accurately. He showed difficulty saying phrases that were similar to but distinct from a common phrase (e.g. Target was: “Say Thanks” but he said: “Thank you”) or a phrase similar to a phrase he targeted in aphasia therapy (e.g. Target was: “Hot Potato” but he said: “Hot dog”). The goal for this study was to increase his ability to say long words and more complex phrases associated with the consistent use of the Therapy application.

2.2 Materials

Pre and Post Measures

A number of clinical tests were used to assess the participant's clinical status on variables such as severity of AOS; his intelligibility; and general feelings of well-being before and after treatment with the Tactus Apraxia Therapy app. In addition, a series of probes were administered pre- and post-treatment to monitor potential changes in the length and complexity of phrases and words produced. This section describes the clinical tests administered and the following section describes the probe lists.

The assessments used for the pre- and post-treatment tests included the Apraxia Battery for Adults-2 (ABA-2; Dabul, 2000), the Assessment of Intelligibility of Dysarthria (AIDS; Yorkston, Beukelman & Traynor, 1984), the Test of Children's Speech (TOCS; Hodge & Goetze, 2014), The Beck Depression Inventory (BDI; Beck, 1961), Dynamic Visual Analogue Mood Scales (D-VAMS; Barrows, 2017), and the ASHA Quality of Communication Life Scale (American Speech-Language-Hearing Association-QCL; Paul et al., 2004) Each of these assessments were chosen to assess the participant's AOS profile and quality of life before and after the study; it was hoped that improved communication ability would improve other aspects of his life.

The ABA-2 (Dabul, 2000) is an assessment designed to identify AOS in adults. This assessment was administered to determine the presence and severity of AOS in the participant. The results of this assessment indicated that the participant had mild to moderate AOS and helped determined the appropriate starting level on the Tactus Therapy Application.

The Beck Depression Inventory (BDI; Beck, 1961) was used to indicate how the participant was feeling before and after the study. Symptoms associated with depressions (e.g. loneliness, sadness, and apathy) are common in individuals who have a communication disorder

(Tanner et al., 1989) and therefore this inventory was used to assess potential changes in the participant's mood as a result of speech treatment outcomes.

The D-VAMS (Barrows, 2017) is a non-verbal assessment designed to analyze the emotions of individuals with communication difficulties (e.g. particularly aphasia) secondary to acquired brain injury. Like the Beck Depression Inventory, this information was particularly useful in tracking the individual's emotional state as it relates to their communication before and after the use of the Tactus Therapy Application.

Finally, the ASHA Quality of Communication Life Scale (American Speech-Language-Hearing Association -Quality of Communication Life Scale; Paul et al., 2004) was used to gain information about the participant's self-perception of speech and communication abilities. This assessment includes 18 phrases about how an individual's communication abilities may affect their daily life. An individual can answer on a scale of zero to five; zero indicating a poor quality of life, and five indicating a good quality of life. The mean of the 18 answers then reveals an average associated with the individual's quality of life.

Baseline and Probe Measures

In addition to determining the participant's clinical status before and after treatment, an assessment was made to determine the phrase and word lengths that could be produced. Three baseline measures of phrase length and of word length were obtained prior to the onset of treatment. In addition, another probe list was monitor progress during treatment. These probes lists were compiled from the single-word test of the Assessment of Intelligibility of Dysarthric Speech (AIDS: Yorkston, Beukelman & Traynor, 1984) and phrases from the Test of Children's Speech (TOCS; Hodge & Daniels, 2007).

The Assessment of Intelligibility of Dysarthric Speech (AIDS; Yorkston, Beukelman & Traynor, 1984) is designed to identify the presence of dysarthria in individuals 12 years of age and older. The test provides a random selection of words to assess a speaker's ability to track a speaker's production of monosyllabic words before, during and after treatment. For the purpose of this study, two sets of words from this assessment were used; one set of 25 words (see Appendix D) was used from the AIDS to assess the participant's ability to generalize what he learned from the application, and the other set of 25 words (see Appendix B) was used as a baseline and probe set which were used to establish his baseline and probe for progress throughout the study. The participant was noted to successfully use words that did not exceed three syllables.

The Test of Children's Speech (TOCS; Hodge & Goetze, 2014) assesses individuals as young as 3 years of age. In addition to assessing words, it also measures phrase production for utterances that vary in complexity from 2-word phrases to 8-word phrases. This assessment was chosen because the participant was noted successfully to produce some two- and some three-word phrases in individual therapy in the IU Speech-Language Clinic. 2 sets of phrases were choosen for this study; one set of Thirty-four phrases (see Appendix C) from the TOCS were used to measure anticipated generalization and improvement in phrase length from pre to post treatment. The second set included 37 phrases (see Appendix A) and they were used to establish the participant's baseline and probe for progress throughout the study. As in the typical administration of the TOCS, phrases were read to the participant and then the participant repeated them.

In addition, the Apraxia Therapy application from Tactus Therapy Solutions© data log was used to observe the participant's amount of independent practice and his production of

target's from the app. For the user log, the participant was asked to send an email of his daily app use to document the activities he practiced; this log comes directly from the Apraxia Therapy application. Within the email, the log included the date, time, and activities completed during home use of the app. The email also included voice recordings of each activity completed. To see example of this log, refer to table 6.

Individual stimuli were considered correct during testing if the participant included each syllable or word included in the target (e.g. if the stimulus is "the bird flies", the participant must have said "the bird flies"). There were instances during testing in which the participant was very close to producing a stimulus (e.g. he said "a cup of coffee" instead of "more coffee"). Instances in which he pronounced a portion of the stimulus correct but not all syllables or words matched the target stimulus, the item was counted as incorrect.

2.3 Study Design

The total duration of this study was seven weeks; refer to figure 2 for a visual of the study design. The participant was seen in the clinic for a total of eight sessions with four sessions used for testing, and four sessions that were conducted during the treatment phase of the study; the first three sessions were reserved for collecting baseline data, which was collected three times. During initial and final testing sessions, the previously mentioned protocols were used to assess the participant's AOS profile, his self-assessment of his communication abilities, and quality of life data. Table 4 presents the results of the pre-treatment testing.

Figure 2. Study Design. Description of weekly testing and therapy with Tactus Apraxia Therapy.

2.4 Setting

The study was conducted in two locations, the IU Speech and Hearing Center and the participant's home. Seven weekly meetings were held in a clinical setting where the participant completed pre-test, post-test, and probe items to track treatment progress. The time at the clinic was also used to rehearse any phrases or words in the Apraxia Therapy application that the participant struggled with and for him to get feedback and guidance from the investigator. The participant completed the rest of the study at home using the Apraxia Therapy application daily on his personal tablet.

Table 4. Pre-Treatment Data

Pre-Treatment Test	**Score**	**Range**
Apraxia Battery for Adults-2 (Dabul, 2000)	Mild-Moderate Apraxia of speech, No Oral Apraxia	
American Speech-Language-Hearing Association -Quality of Communication Life Scale; Paul et al.; ASHA QoCL; 2004)	Average Score: 3.76	min:1; low quality of life-max:5; high quality of life
Dynamic Visual Analogue Mood Scales (D-VAMS; Barrows, 2017);	Composite Average: 80.7	
The Beck Depression Inventory (BDI; Beck, 1961	8	A score between 1-10 indicates normal ups and downs and is considered a good score

TOCS (Hodge & Goetze, 2014)	(2/34) = 0.05%	0-100%
AIDS (Yorkston, Beukelman & Traynor, 1984)	(21/25) = 84%	0-100%

Baseline data were collected during the first three meetings using portions of the TOCS and the AIDS. The phrases and words used for the baseline data can be found in Appendix C and D. Table 5 and Table 6 display the baseline scores of the participant, including the percentages of TOCS phrases and AIDS words produced correctly.

Table 5. TOCS Baseline Data

Test of Children's Speech (TOCS) Baseline/Probe Phrases	
Baseline 1	(2/32) = 6%
Baseline 2	(1/32) = 3%
Baseline 3	(3/32) = 9%
Average Baseline (SD)	**2/32 (1) = 6% (SD=3)**

Table 6. AIDS Baseline Data based 25 AIDS words

Assessment of Intelligibility of Dysarthric Speech (AIDS) Baseline/Probe words	
Baseline 1	(21/25) = 84%
Baseline 2	(20/25) = 80%
Baseline 3	(21/25) = 84%
Average Baseline (SD)	**(20.8/25) = 83% (SD=2.3)**

The participant was asked to use the Tactus Therapy Application five days a week for at least 30 minutes a day over a 4-week period. The participant was also asked to document the use and details of the activities completed within the application on a documentation log. The daily data log was sent via email to the investigator from the application. Table 7 presents a sample data log.

Table 7. A sample user log

"Client completed a phrase speaking exercise using the Apraxia Therapy app from 11:21 PM on February 20, 2020 to 12:18 AM on February 21, 2020"

Phrases	**Level**	**Self-Rating**	
1.	Hello.	1	Good
2.	Goodbye.	1	Good
3.	Come here.	1	Good

For the purposes of this study, the participant was asked to use the application for 30 minutes each day; however, he was not told what phrases and words to practice. The participant chose his own words and phrases to practice, which varied in difficulty. The time frame of 30 minutes was used to ensure that the participant interacted with the application enough times to make potential growth throughout the study, but that he was given the freedom to choose the work to increase self-motivation.

A voice recording of each word and phrase produced by the participant when he worked with the app was also collected. The participant was taught by the investigator on how to rate his productions for each recording. Although the participant provided his rating of production quality, as described above, the investigator assigned a separate rating based on their initial

assessment of the participant's performance of each word or phrase. The rating completed by the investigator was then compared with the rating of the participant for 15 words and 15 phrases to determine correlation of the participant's ratings. This comparison was used to see if the participant's perspective of matched that of an unbiased listener.

Once a week over the next 4-weeks following the initial meeting, the participant met in a clinical setting to review and practice a few of the activities completed in the application for the week and recite a set of probe words and sentences. The words and phrases in the app that the participant rated as "not good" or "okay" for the week were chosen to practice during the weekly meetings. This practice included the Integral Stimulation model used on the Tactus Therapy application; the service model included listening to the phrase or word; tapping to the modeled production of each word or phrase; saying the word or phrase together with the clinician; fading out part of the word by the clinician and allowing the participant to say it independently; and finally having the participant say the word or phrase independently as a whole. The participant was also able to ask questions about the Tactus Application, and comment on any progress made at this time.

The final meeting consisted of reevaluations of the participants Apraxia severity, self-assessment of communication abilities, and quality of life data. The same protocols were used (e.g. the ABA-2, the Beck Depression Inventory, the D-VAMS, and the ASHA Quality communication Life Scale) to compare changes over the course of the case study. Finally, the TOCS phrases in Appendix C and the AIDS words included in Appendix D were used to test generalization of knowledge from the Apraxia Therapy application (see section 2.2).

Data Analysis

Descriptive data were used to share the results of the study. The mean differences between baseline data and post-test were used to show the overall change in his ability to produce increased phrase and word length after treatment. In addition, the minimum detectable change was calculated as the necessary difference between the average pretest baseline on the TOCS and AIDS and the post-test measures on those tests. The MDC is defined as the magnitude of change needed between pre- and post-test values to assert that the differences is not due to measurement error. A difference between pre- and post-test values that exceeds the MDC is considered to be a true difference (Segura-Orti & Martinez-Olmos, 2011). As noted by Segura-Orti & Martinez-Olmos, MDC_{95} is calculated as:

$$MDC_{95}=SEM\times1.65\times\sqrt{2}$$

Based on the three pretest administrations of the TOCS, the MDC_{95} would be a post-test score that was at least 2.77 correct productions above the baseline average of 2 correct productions (see table 5). The MDC_{95} for the AIDS is 1.6 above the baseline average of 20.8. (see table 6)

Descriptive data explain the difference between the participant's self-perception of his performance in the Apraxia Therapy application and the perception of the investigator. Descriptive data will also be used to explain the usefulness of the application features and potential drawbacks of using it individually without the guidance of a speech pathologist. Correlation coefficients were computed to assess the agreement in quality of utterance production (i.e., good, okay, not good) between the participant and the investigator.

Chapter 3

Results

The change in standardized test scores over a 4-week period of using the Apraxia Therapy application is found in table 8, while the change in TOCS and AIDS data can be found in tables 9 and 10. Fifteen phrases and fifteen words were selected from each section of the application and the original rating of the production of the words and phrases from the participant was compared to the rating of the investigators. The ratings were compared to see if the participant accurately judged his performance without the help of a professional; the results of these comparisons can be found in tables 11 and 12.

Table 8. Pre-Test and Post-test Data

	Pre-Test	**Baseline Average**	**Post-Test**	**Raw Difference**
ABA-2	Mild-Moderate Subtest 2 & 3: 50%	-	Mild-Moderate Subtest 2 & 3: 84%	34% increase
Beck Depression Screener	8	-	4; A score between 1-10 indicates normal ups and downs and is considered a good score	4-point reduction
ASHA QCOL	3.76	-	4.11	.34-point increase

D-VAMS	Composite Average: 80.7	-	Composite Average: 90	9.3 increase

Table 9. TOCS Phrases Pre-Test and Post-Test Data

	Pre-Test	**Baseline Average**	**Post-Test**	**Raw Difference**
TOCS Generalization Phrases	5%	-	10%	100% increase
TOCS Baseline/Probe Phrases	-	22%	72%	50% increase

Table 10. AIDS Words Pre-Test and Post-Test Data

	Pre-Test	**Baseline Average**	**Post-Test**	**Raw Difference**
AIDS Baseline Words	84%	-	100%	12% increase
AIDS Probe Phrases	-	83%	100%	17% increase

Table 11. Participant and investigator judgments of accuracy of word production from a subset of words from Tactus® Apraxia Therapy app.

Word length	Participant judgment	Investigator judgment	Percent agreement
2 syllable words	**5/5 good**	**3/5 good** **2/5 okay**	**60%**
3 syllable words	**5/5 good**	**2/5 good** **3/5 okay**	**40%**
5 syllable words	**3/5 good** **1/5 okay** **1/5 not good**	**1/5 good** **1/5 okay** **3/5 not good**	**40%**
Average percent agreement (SD)			**46.7% (11.5)**

Table 12. Participant and investigator judgments of accuracy of phrase production from a subset of words from Tactus® Apraxia Therapy app. All words and syllables had to be produced correctly to receive a rating of "good".

Phrase length in words (number of syllables in phrase)	Participant judgment	Investigator judgments	Percent agreement
2 words (2 syllables)	5/5 good	2/5 good 2/5 okay 1/5 not good	40%
2 words (3 syllables)	4/5 good 1/5 okay	1/5 good 1/5 okay 3/5 not good	20%
3 words (3 syllables)	4/5 good 1/5 okay	2/5 good 1/5 okay 2/5 not good	60%
Average percent agreement (SD)			40% (20)

The assessments aforementioned used for pre and post testing were chosen to show potential changes in the participants Apraxia of Speech severity, his ability to recite words and phrases, and his self-perception of their communication in daily life. The participant did show changes across each assessment, phrase list, and word list. Statistical test were not used to compare pre-test and post-test data for the standardized assessments.

The ABA-2 did not change when considering the participant's Apraxia of Speech severity, mild-moderate. However, the individual subtests of the assessments did see slight changes. For example, the participant was able to produce a few more complex words (e.g. 4 syllable words) in subtests 2 and 3, "Increasing word Length" after treatment compared to during pre-treatment testing. This seen in Table 7 by the 34% increase in ABA performance from the pre-test to post-test scores.. The participant was also able to produce more words and phrases for the spontaneous speech portion of subtest 6, "Inventory of Articulation Characteristics of Apraxia." It should be noted that the participant previously provided one word to describe the picture of the circus during the pre-test, and used 2 phrases and 2 words for the post-test description.

The Beck Depression Inventory considers any score between 1-10 to be normal (BDI; Beck, 1961). The participant's pre-test score was an 8. At the conclusion of the study this score reduced to a 4. Both of these numbers are in the 1-10 range indicating normal ups and downs; they are both considered a good score.

D-VAMS scores are presented in percentile form in table 8. At the beginning of the study, the participant fell into the 83.8th percentile. Following the study, the participant fell into the 93.5th percentile. The increase shows a positive change in participant's emotions after treatment.

The final assessment, the ASHA Quality of Communication Life Scale, is scored by finding the average of an individual's responses to 18 phrases pertaining to communication-based quality

of life situations (e.g. “I like to talk with people”). The participant was asked to rate each phrase on a scale of 0 to 5. A score of 0 may indicate that the individual is experiencing a low quality of life, while a score of 5 indicates a better quality of life. At the start of the study the participant averaged a score of 3.76. By the end of the study, the participant averaged a score of 4.11 , which shows a self-perceived improvement in the participant’s quality of life.

The participant initially produced 2 of the 34 phrases correctly (i.e. 5%) from the TOCS generalization phrases in Appendix A. By the end of the study he recited 4 phrases correctly, showing a 100% increase in the phrase production; however, small change in the number of phrases produced correctly after treatment, did not exceed the MDC_{95} value of 2.77 for the TOCS . Furthermore, the participant recited the TOCS baseline/treatment phrases (Appendix C) with an average of 22% correct productions over 3 baselines. After the study, the participant recited 72% of the phrases indicating a 50% improvement. The participant sometimes required two models of the probe phrases however; he typically produced each phrase correctly for majority of the study following the pre-test phase.

When considering the breakdown of the phrases the participant produced during the pre-test and post-test assessment, the participant produced 2 phrases out of the 34 (e.g. “more cake” and “stop the music”), which included 5 total words. By the end of the study, he produced 4 phrases out of the 34 (e.g. “more cake”, “buy coffee”, “stop the music”, and “smell the rose”), which included 10 total words; this shows that he doubled his phrase word production over the course of the study although his longest phrase (e.g. a 3-word phrase) did not improve over the course of the study. The production of the TOCS phrases did not greatly improve as a result of the Tactus Therapy treatment in that the participant was able to recite 4 new 2-3-word phrases on the first attempt after therapy in comparison to the 2 phrases he produced before treatment..

The word sets from the AIDS saw a greater increase as the participants pre-test score average of 84% on both the generalization probe of AIDS list (Appendix B) and the treatment probe AIDS list (Appendix D) increased to 100% by the end of the study. For the AIDS generalization list, the participant originally produced 21 out of 25 words correctly and by the end of the study he successfully produced all 25 words; with a four word increase, he exceeded the MDC_{95} value of 1.60 for the AIDS showing a significant change in the data.

Inter-rater agreement

Fifteen words and fifteen phrases from the participant completed stimulus in the Apraxia Therapy application were randomly selected by the investigator to rate. The words and phrases included stimuli across difficulty levels and the comparisons between the participant and investigator judgments can be found in Figures 2 and 3. The percentage of agreement for the 15 phrases was 33% while the percentage of agreement for the 15 words was 40%; this data can be found in in tables 11 and 12.

When considering the changes in data as a whole, the participant had positive changes in his mood and self-perception of his communication, a minimal increase in his ability to produce longer phrases with accuracy on a first attempt, and a moderate increase in ability to produce words with accuracy on a first attempt.

Chapter 4

Discussion

4.1 Discussion

Health care has shown an increasing use of technology in therapy (Wallace, Graham & Saraceno, 2013), in general, and in treatment for communication disorders. (Ballard, Etter, Shen, Monroe & Tan, 2019; Stark & Warburton, 2018). The current study aimed to extend the evaluation of tablet-based apps to treatment for AOS. This study had two goals; one was to see if the use of the Apraxia Therapy application would promote generalization to the participant's production of phrases and words outside of the stimuli provided in the application. Secondly, this studied aimed to see if the participant could independently and accurately judge the quality of his own productions without professional guidance. The participant was asked to focus on the phrases and long words portions of the Apraxia Therapy application. Pre- and post-test data revealed some improvements in the speech production abilities of the participant, as well as changes in his self-perceived mood.

4.1.1 Change in TOCS, ABA-2, and AIDS Data

Although the participant used the application everyday over the 4-week timeline, this did not greatly improve his ability to produce unpracticed 3-5-word phrases on a first attempt, as measured by his performance on the TOCS baseline phrases after therapy (see table 8). There was only a .5% increase in accuracy of production of the generalization phrases (Appendix A) from pre to post treatment testing. By contrast, there was a 50% increase in his production accuracy of the untreated phrases that were used to probe his progress during treatment (Appendix C); it should be noted however that his baseline score on these phrases did show slight difference over the three baselines (see table 4). The difference in improvement across

these two lists must be considered in light of the number of times the participant was exposed to each set. The baseline/probe phrases likely saw a greater increase because the participant practiced them 4 times over the course of the study. Although the participant improved in production of the probe phrases, this knowledge did not generalize to production of less well-known phrases in Appendix A, an effect that has been documented in previous research (Winner & Elbert, 1988).

The participant's change in word production length and accuracy was more impressive and also correlates with the participant's daily performance on the Apraxia Therapy application. At the start of the study, the participant had greater skill in producing 1-2 syllable words than 3 syllable words on the first attempt; this is shown by his 84% accuracy on the pre-test AIDS data which only included 1-2 syllable words (Appendix B). Comparatively, the participant produced only 50% of the three-syllable words included in the ABA-2 subtest 2 and subtest 3 at the beginning of the study. By the end of the study however, the participant produced both the pre-test (Appendix B) and baseline (Appendix D) sets of AIDS words with 100% accuracy on the first attempt, and the number of 3-syllable words he could produce on the ABA-2 subtests increased to 80%. Only one set of words (i.e. the AIDS probe words) was consistently practiced over the 4-week period of the study.

Based on these data, it is likely that the consistent practice of words of different lengths within the Apraxia Therapy application generalized to the overall increase of word length and accuracy in the post-data. Furthermore, it is likely that the focus on phrases and complex words in the application had an effect on the participant's ability to say more multi-syllabic words and to create phrases about the photo included in the ABA-2 assessment. The participants improvement in the single words portion of the assessment aligns with findings of previous

research. According to the study completed by Ballard et al. in 2019, each participant improved the accuracy of the word production after using Automatic Speech Recognition (ASR) software. The relation between the two results may show that application-based therapy is likely to improve word production for individuals with AOS and/or aphasia.

4.1.2. Change in non-speech metrics

The BDI (Beck, 1961), D-VAMS (Barrows, 2017), and the ASHA-QCL (Paul et al., 2004) were used to assess the participant's overall change in mood and self-perception of his communication. The 4-point change in the BDI score suggests a reduction in the participant's depression; although both the pre- and post- test scores are within the "normal" range for the BDI, one should consider the difference between the pre- and post-test scores. Like the BDI, the D-VAMS was used to test changes in the participant's mood. The improvement of his overall percentile ranking from the pre- to post-data suggests that he identified with more positive emotions following the study. Although both of these scores improved, it should be considered that these scores could have changed due to a number of environmental factors that were not measured, in addition to the usage of the Tactus Therapy application.

Because the ASHA Quality of Communication Life Scale is directly related to conversational skills, it is likely that the use of the application impacted the participant's perspective on quality of life. His mood and self-perception of his communication skills likely changed because he enjoyed the straightforwardness of the application. The participant consistently mentioned that the Apraxia Therapy application was easier to use than the other applications he was using in individual therapy. Ease of use likely made the participant more excited and willing to use the application, which he used twice a day over a 4-week period.

4.1.3 Judgments

When comparing the investigator ratings and participant ratings of the recordings for each word and phrase chosen, it is clear that the rating of the investigator did not often match the rating of the participant (see figure 4). Review of the audio recordings of the participant's practice session with the app revealed that there were times when the participant was saying a word well however, it was not the target word (e.g. saying intermediate for intimidating). In these cases, the participant rated his production as "good," but the investigator gave the erred word production as "not good." The investigator also rated the utterance production as "Not good" when the participant was noted to perseverate on the previous target word when recording the new word. Although the word production was clear and precise, it was not the target word. Finally, when the investigator rated a word as "okay" the participant often said the majority of the word or phrase correctly but missed a key sound (e.g. saying peautiful for beautiful).

4.2 Clinical Implications

Based on the results of this study one can see that the Apraxia Therapy application helped the participant improve his speech production. The ease of use of the application left the participant engaged and confident about the work he was completing. While this application did not always yield accurate independent judgments of phrase and word production from the participant, this tool would be great to use in conjunction with structured speech therapy sessions.

When considering the use of the Apraxia Therapy application in the clinic setting, the professional guidance of a speech pathologist is required to gain the most success. A speech pathologist would provide the proper judgments for the client's production and also give structured feedback to augment the application's use. Input from a speech pathologist may aid gains in generalization and usage outside of the application. Additionally, a speech pathologist

can use the same scaffolding service model the application uses for stimulus words that are not included in the application to further tailor therapy to the individual.

When clients are using this application by themselves, they may make errors and it may teach them to produce words in the wrong way. By reviewing the productions of the stimuli while the speech pathologist is present, the client can gain the feedback they may require which is not available within the application.

Furthermore, a speech pathologist can provide structured practice of all stimuli within the application. They could assign a number of times for the client to complete each stimulus at home and they can also use the app's stimuli during their therapy sessions; providing a more controlled environment for the application usage with increased practice of stimuli will increase the opportunity for generalization.

Finally, a speech pathologist can use the same scaffolding service model the application provides for other stimuli outside the application. Although the application provides variety, the stimuli it provides are not customized to the client. By using the same service model with new stimuli that are more applicable to the client, a speech pathologist could supplement the use of the application beyond its technological basis. This would allow the client to use this model regardless of their location or if they have the application right in front of them.

This study hoped to find the answers to two questions; can a therapy-based application provide generalization to unpracticed phrases and words outside of the app for individuals with AOS, and can the user accurately judge their own productions without the help of a speech-language professional? Based on the findings, the app provided minimal generalization for phrases and a moderate generalization for words. Additionally, the participant did not accurately judge his productions majority of the time when compared to the judgements of a speech

pathology graduate student. When considering non-speech metrics, the participants self-perceived mood improved after using the application and he reported enjoying the ease in the use of the application. Overall, the app provided improvements in the participant's speech output and their outlook on their communication.

Chapter 5

Limitations and Conclusion

5.1 Limitations

This study was designed to test the use of a therapeutic app and its ability to improve the speech complexity and accuracy of an individual with Apraxia of Speech with limited professional guidance. While the results suggest that professional guidance is needed to have maximally successful use of the application, the study only included one participant. Also, there was no condition in which the participant did not get weekly input from the investigator; so the impact of professional guidance can only be inferred from the current data. Therefore, the results are specific to the needs and performance of one individual with Apraxia of Speech. Future studies should include a larger pool of participants to understand how useful this application is on a large scale. Inclusion of more participants may allow for more experimental control by using a single-subject, multiple-baseline across participants design.

5.2 Conclusion

Results of this study indicate that the Apraxia Therapy app led to some improvements in speech production for this participant. He saw a moderate increase of 16% in AIDS word production and a minimal increase of .5% in the production of TOCS phrases. Furthermore, his overall self-perceived mood improved across all non-speech metrics (i.e. the BDI (Beck, 1961), D-VAMS (Barrows, 2017), and the ASHA-QCL (Paul et al., 2004)). Although, therapeutic applications can be helpful in providing extra practice for a client, the inclusion of guidance by a professional may improve its overall effectiveness and generalization outside of therapy. While the model of service included within the Apraxia Therapy application is user-friendly, the lack of

professional feedback for the user may delay his overall progress and accuracy with the stimuli presented.

This study shows that a useful therapy tool for individuals with AOS, which is included in the Apraxia Therapy application, could be integral stimulation however, the most useful aspect of the study was the amount of time the participant spent with the application. Continuous practice with the stimuli on a daily basis likely had the greatest effect on the participant's improvement. Further research on this topic could measure the ability for participants with different profiles to generalize phrase and word production after the use of the Apraxia Therapy application.

Appendix A. TOCS Pre-test and Generalization Phrases

1	Get on
2	Sticky bib
3	More cake
4	Buy coffee
5	Write to grandma
6	Fold these socks
7	Fill his bowl
8	Stop the music
9	Smell the rose
10	Some ham and cheese
11	A very hard puzzle
12	They have funny noises
13	Hang up the picture
14	Pack the big suitcase
15	Send some Christmas cards
16	Jam is on her face
17	They will have a picnic
18	A new box of paints
19	The thin line is orange
20	A blue and white cup
21	His teeth are very sharp
22	They are learning about numbers

23	He wants soup but not crackers
24	The paper's folded into a dog
25	This is the hat she wore
26	She can't see ant cookies now
27	She's going to comb her hair
28	Cover your mouth when you cough.
29	He is washing and she is drying
30	The loud noise scared the cat.
31	Dad found a bat in the house
32	They are ready to start the race
33	He opened his umbrella because it rained
34	The boy who bought the candy is sharing

Appendix B. AIDS Pre-test and generalization Words

1	Corn
2	Trade
3	Fear
4	Tool
5	Bitten
6	Spark
7	Best
8	Glitter
9	Quart
10	Red

11	Seat
12	Timber
13	Horn
14	Wine
15	Able
16	Nap
17	Beat
18	Feel
19	Paid
20	Crawl
21	Pole
22	Preach
23	Pain
24	Limb
25	Rut

Appendix C. TOCS Baseline and Probe Phrases

1	Fix it
2	That cup
3	Long hair
4	Hot Potato
5	Bite Pizza
6	Say Thanks
7	Button Jar

8	Paint shirt
9	Baby Sock
10	Shake Hands
11	Little finger
12	Eat bananas
13	Picnic basket
14	White beads
15	Kitchen clock
16	Good spaghetti
17	Open the door
18	Take a break
19	He is happy
20	Push the car
21	Press the leaf
22	Color a shape
23	Draw a circle
24	Cut it straight
25	Try once more
26	Feel his tongue
27	Help bake cookies
28	Wear these pants
29	Share the peanuts
30	Don't hurt puppy

31	Big warm mittens
32	Another yellow balloon

Appendix D. AIDS Baseline and Probe Words

1	Occur
2	Repress
3	Torch
4	Bit
5	Grow
6	Rate
7	List
8	Wipe
9	Shot
10	Car
11	Often
12	Flaw
13	Sew
14	Rake
15	Closure
16	By
17	Defy
18	Limb

19	Other
20	Scram
21	Art
22	Glow
23	Raid
24	Pave
25	Hear

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Jasmine Orr

Objective

Obtain a Clinical Fellowship in speech-language pathology within a team-centered and supportive environment focusing on evaluation and treatment of neurogenic disorders.

Education

Indiana University Bloomington — **Major:** M.A. in Speech and Hearing Sciences
Graduation Date: June 2020

The University of North Carolina at Greensboro — **Major:** B.S. in Speech Pathology, B.A. in Spanish
Minor: American Sign Language
Graduation Date: May 2018

Practicum Experience

Indiana University Bloomington- Bloomington, IN
Graduate Clinician **Fall 2018- Current**

- Collaborate with clients and caretakers to create a treatment plan that encompasses their dynamic needs
- Collect pertinent background information and assess speech and language skills to accurately diagnose a client
- Implement evidence-based treatment plans with other graduate clinicians to develop group intervention for adult clients with various cognitive and communicative needs
- Facilitate and score language and motor speech testing for clients to aid in the identification of a speech and language disorders and potential therapy goals
- Engage with established voice therapy protocols for individuals with vocal dysfunction
- Design and execute treatment plans for individuals and groups with a variety of disorders in a school-based setting.
- Engage with a client and evidence-based treatment protocols to create and individualized treatment plan for cognitive deficits

Externship- Bloomington, IN
Templeton Elementary- Bloomington, IN **Expected January 2020-March 2020**

- Prepare and implement treatment plans for a variety of students and disorders.
- Assist supervisor in evaluation and identification of students with speech and language disorders.

IU Bloomington Hospital- Bloomington, IN **Expected April 2020-June 2020**

- Collaborate with supervisor in evaluation and explanation of MBSS information for patients.
- Organize and complete evidence-based therapy for a number of patients with cognitive and swallowing disorders.

Recent Employment

Indiana University Bloomington- Bloomington, IN
Research Assistant **Spring 2019-Current**

- Transcribe narrative data to assist in further understanding a client's Aphasia profile
- Use Chat & Clan to code and analyze narrative data.
- Score formal language and cognitive-based assessments to assist in creating data for Aphasia Research
- Facilitate language and cognitive testing on healthy and impaired individuals to aid in Aphasia research

Graduate Assistant **Fall 2018-Spring 2019**

- Facilitated office hours and aided students with classwork outside of class
- Assisted the professor with assessment and in-class assignments
- Completed classroom grading
- Managed class schedules and task when professor was absent

Target- Bloomington, IN

Closing Expert **Summer 2019- Current**

- Organize products on the sales floor to reflect the interests of each customer
- Utilize time management to ensure that inventory and products are reconditioned before store closure
- Engage with each customer to provide informed solutions and an exceptional customer experience.
- Collaborate with team members to guarantee the completion of closing task
- Adopt the different roles around the store when needed to promote fluid store production

Memberships & Certifications

National Student Speech Language Hearing Association [NSSLHA] Member, 2019
American Heart Association, BLS